

**SOUTHWEST FISHERIES SCIENCE CENTER
FOURTH QUARTER REPORT – FY 2004
For the period July 1–September 30, 2004**

LA JOLLA LABORATORY - ANTARCTIC ECOSYSTEM RESEARCH DIVISION

Submitted by: Rennie S. Holt, Director, Antarctic Ecosystem Research Division.

Title of Accomplishment or Milestone: Attend and participate in a meeting of the Scientific Committee on Antarctic Research (SCAR).

Current Status: Completed.

Background Information: The SCAR is a non-governmental organization created in 1958 and charged to initiate, promote, and coordinate international scientific activity in the Antarctic with a view to framing a scientific program of circumpolar scope and significance. Additionally, SCAR is commissioned to review scientific matters pertaining to the integrity of the Antarctic environment, including the conservation of its terrestrial and marine ecosystems, and to provide scientific and technological advice to the Antarctic Treaty consultative meetings and other organizations (governmental and non-governmental). The Antarctic Treaty governs science activities of member nations in Antarctic, including the United States. The role of SCAR, as codified in the Environmental Protocol of the Antarctic Treaty, is to provide consultation on matters ranging from the development of environmental monitoring guidelines to the review of areas proposed for special management. The SCAR has also been instrumental in directing and advising proposed activities for the International Polar Year (2007-08).

Purpose of Activity: Review the current status and perspectives of Antarctic science.

Description of Accomplishment and Significant Results: All disciplines of Antarctic research were considered at the 28th meeting of the Scientific Committee on Antarctic Research. For the first time since its foundation in 1958, SCAR held an open international and interdisciplinary scientific conference on “Antarctica and the Southern Ocean in the Global System.” The Open Science Conference reviewed present understanding of the close couplings between Antarctica, the Southern Ocean and the other parts of the Earth System and provided a good opportunity to find out about the current status and perspectives of Antarctic science. The outcome of the conference is expected to influence the planning of SCAR’s future Antarctic research programs. Approximately 850 scientists from 39 countries attended the SCAR meeting, held in Bremen, Germany, during the last week in July 2004, and contributed more than 700 abstracts relating to various items on the agenda. Several International Polar Year planning and discussion meetings also were held. The meeting publicized the activities of SCAR and the International Polar Year, bringing them to the attention of politicians, the media, and the public. The final report of the meeting is more than 25 pages long and contains several recommendations to the SCAR Life Sciences Standing Scientific Group.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): Several Antarctic Ecosystem Research Division scientists and cooperative principal investigators presented talks or poster sessions at the SCAR meeting. In addition, several papers from the meeting were of direct relevance to division research. Several

sessions at the meeting addressed planning for the upcoming International Polar Year, which is of direct interest to the AMLR Program and NOAA, a key organization participating in International Polar Year activities.

Key Contact: Rennie Holt, (858) 546-5601.

Submitted by: Rennie S. Holt, Director, Antarctic Ecosystem Research Division.

Title of Accomplishment or Milestone: Convene CCAMLR Working Group on Ecosystem Monitoring and Management (WG-EMM).

Current Status: Completed.

Background Information: The United States is a signatory to Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), part of the Antarctic Treaty system. CCAMLR is an international fisheries agreement with mandates to apply an ecosystem approach to fisheries management and to adopt precautionary positions in the face of uncertainty. The Convention, currently consisting of 24 member nations, established a Commission and a permanent Secretariat that function as policy-making body and central administration. The Commission solicits advice from the Scientific Committee, which has established two primary working groups: one on fish stock assessment (WG-FSA) and the other on ecosystem monitoring and management (WG-EMM). These working groups conduct various intercessional activities, meet formally once a year, and present their recommendations to the Scientific Committee.

With regard to the fishery on Antarctic krill, CCAMLR is currently at a juncture in the evolution of its management scheme. The concept of an ecosystem approach to management has proved difficult to define and implement in terms of operation rules for managing the fishery. In the absence of information regarding demand by krill predators, dispersion and movement of krill throughout their habitat, and variability in recruitment and the factors that control it, a population yield model, which incorporated uncertainty in these parameters, was adopted in order to establish a precautionary limit to harvesting. In the meantime, WG-EMM has adopted a long-term work plan to develop the tools necessary for incorporating more of the natural history of Antarctic krill into an enhanced management procedure.

Purpose of Activity: To review the status and trends apparent in the krill fishery and the krill-centric ecosystem and from these considerations formulate advice for the Scientific Committee and Commission. In accordance with its long-term plan, WG-EMM devotes a substantial portion of its annual meeting each year to the consideration of a particular issue. During the 2004 meeting, a workshop was conducted to look at conceptual models for fisheries management.

Description of Accomplishment and Significant Results: The 2004 meeting of WG-EMM was held in Siena, Italy, during the middle two weeks in July. The meeting was convened by SWFSC scientist Roger Hewitt (USA). Approximately 50 scientists attended the meeting and contributed more than 70 working papers relating to various items on the agenda. The final report is more than 100 pages long and contains several recommendations to the Scientific Committee. The most important of these is a series of recommendations regarding the 20-year-old CEMP (CCAMLR Ecosystem Monitoring Program). These recommendations arise from

considerations of the original objectives of the program (to detect and separate changes to the system due to environmental influences and the effects of a krill fishery), the power of the data sets to detect a range of changes, refinements to the design of the observation program, and the use of CEMP data in the provision of management advice. It is expected that the CEMP will ultimately be a key element in a revised management procedure for the krill fishery whereby feedback from local monitoring is used to adjust controls on the fishery. Formalization of the revised management procedure is the principal objective of the long-term work plan of WG-EMM and will require several more years to complete.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): The fishery on Antarctic krill may be of interest as a model for fishery management development for several reasons: a) it is targeted on a prey species; b) it is controlled by international agreement; c) this agreement is committed to preserving the stability and diversity of the pelagic ecosystem; and d) the kinds of information required to manage the fishery and the decision rules for its use are evolving as we learn more about the system. Many fisheries throughout the world share one or more of these characteristics, and the lessons that can be derived from the Antarctic krill fishery may have wide applicability.

Key Contact: Rennie Holt, (858) 546-5601.

Publications

Rutishauser, M. R., D. P. Costa, M. E. Goebel, and T. M. Williams. 2004. Ecological implications of body composition and thermal capabilities in young Antarctic fur seals (*Arctocephalus gazella*). *Physiol. Biochem. Zool.* 77(4).

W. Trivelpiece tabled the AMLR Field Season Report at the WG-EMM meetings in Siena, Italy. "Seabird Research at Cape Shirreff, Livingston Island, Antarctica, 2003-2004," by M. Antolos, A. Miller, and W. Z. Trivelpiece.

W. Trivelpiece presented a poster at the SCAR Symposium in Bremen, Germany. "The winter distributions of chinstrap penguins from two breeding colonies in the South Shetland Islands, Antarctica," by S. Trivelpiece and W. Trivelpiece.

LA JOLLA LABORATORY - FISHERIES RESOURCES DIVISION

Submitted by: Roger Hewitt, Director, Fisheries Resources Division.

Title of Accomplishment or Milestone: Southern California juvenile pelagic shark survey.

Current Status: Completed.

Background Information: Fishers ply the U.S. coastal and offshore waters between the borders of Mexico and Canada seeking swordfish (*Xiphias gladius*), tuna (*Thunnus* spp.), thresher shark (*Alopias* spp.), shortfin mako shark (*Isurus oxyrinchus*), and a variety of marketable but incidental species. An important bycatch of those fisheries is the blue shark (*Prionace glauca*), which is for the most part discarded at sea. An examination of the historical fishing and length-frequency data from the California/Oregon driftnet fishery indicated that west coast thresher shark stocks overfished in the early 1980s were rebounding in response to fishing regulations introduced in the mid-1980s. Determining trends in relative abundance for shortfin mako and blue sharks was more problematic because of evolving regulations affecting the fishery and the non-target status of those sharks.

In an effort to address concerns for a sustainable fishery on local stocks of pelagic sharks, the division initiated an abundance survey for juvenile sharks during 1994. The California-based longline fishery (1988 and 1991) targeted mostly juvenile shortfin mako and blue sharks. This short-lived shark fishery provided baseline data from which an index of relative abundance could be constructed. These shark species are managed under the west coast fishery management plan for highly migratory species. SWFSC staff will be conducting stock assessments for shortfin mako and thresher shark populations in FY05 and updating stock assessment and fishery evaluation reports annually thereafter. In support of assessments, indices of relative abundance and changes in size and catch can provide fishery managers with important information on stock condition.

Purpose of Activity: Provide fishery-independent data on relative abundance, size of catch, and life history parameters needed to address issues of stock condition of pelagic sharks managed by fishery management plan.

Description of Accomplishment and Significant Results: The 2004 shark survey was completed July 7. A total of 6,692 hooks were fished at the 38 sampling stations. Captured sharks were tagged with conventional spaghetti tags, satellite transmitting tags and oxytetracycline (OTC). Catch included 88 mako sharks, 127 blue sharks, 2 common thresher sharks, and 59 pelagic rays. The preliminary data indicate overall catch rate was 0.399 sharks per 100 hook-hours for mako sharks and 0.499 sharks per 100 hook-hours for blue sharks. The catch per unit effort (CPUE) for mako sharks was slightly higher than 2003 but continues a declining trend. The CPUE for blue sharks was slightly lower than in 2003 and also continues a declining trend.

In addition, 62 sharks were tagged with conventional tags for movement data, 61 sharks were marked with OTC for age and growth studies, and 74 DNA samples were collected. Three adult blue sharks were tagged with a total of 6 satellite archival tags in a cooperative Tagging of Pacific Pelagics project to define the physical habitat of Pacific blue sharks. Four satellite pop-up tags and nine satellite transmitter tags were deployed on 10 individual mako sharks in a

continuing series of habitat, migration, and condition studies. Two common thresher sharks were also tagged with satellite pop-up and transmitter tags. Early results indicate blue and mako sharks surface briefly, and data transmissions are providing temperature, depth and location data. Five pelagic rays were collected by University of California Los Angeles graduate students for growth and ageing studies. Monterey Bay Aquarium staff tested a new transport system designed to move live mako sharks to the Monterey Bay Aquarium for display purposes. A contract photographer from National Geographic documented the survey operations during leg 1 of the survey.

Research conducted concurrently over the entire survey period included:

1. Conventional tags were deployed on most sharks as time and conditions permitted. Total tags deployed exceeds 2,400 sharks. To date the recapture rate for shortfin mako shark is 4.3% and 11.8% for the common thresher shark.
2. Electronic tags were deployed on several sharks to study their movements and habitat preferences. In 1998 and 1999, common thresher sharks were tagged with acoustic tags and tracked for several days in the vicinity of Santa Monica Bay off Malibu, California. From 2002 to 2004, 12 blue sharks, 31 mako sharks, and 6 thresher sharks were tagged with pop-off satellite archival tags and real-time satellite transmitting tags. The figures below show tracks of mako and blue sharks as reported by the real-time transmitting tags (Fig. 1, Fig 2.).
3. Beginning in 1998, selected shortfin mako and common thresher sharks were injected with quantities of OTC for age and growth studies. A total of 450 shortfin mako and common thresher sharks were marked with size-specific quantities of OTC. Total recapture rate to date is 3.8%. Analysis is continuing by Center staff in the shark laboratory as samples are returned.
4. Survival of pelagic fish after release from fishing gear is important in terms of tag recapture analysis and for use in stock assessments. Blood was drawn from 74 mako, 68 blue, and 57 thresher sharks for studies on condition at capture and post-release survival studies. Preliminary assay of blood chemistry indicates very high catecholamine and lactate levels in all three species when compared to resting, captive sharks.
5. Beginning in 2001, DNA samples were collected from selected individuals for population and differentiation studies. These samples are currently queued for analysis in the division's DNA laboratory. Heart, liver, gonad, and muscle tissue are collected for a variety of ongoing studies, including reproductive condition, heavy metal and DDT concentrations, and biochemical analysis. Stomachs are collected from moribund sharks for feeding pattern studies and to supplement ongoing food habitat studies at the shark laboratory. Physiological studies of swimming energetics were conducted in a self-contained, variable speed water tunnel on 4 shortfin mako sharks and 6 pelagic rays.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): This survey provides data on relative abundance, size of catch, and life history parameters needed to address issues of stock condition. This is the only fishery-independent survey for pelagic sharks off the western United States. The fishery management plan for highly migratory species establishes the requirement for stock assessment and fishery evaluations for these pelagic

sharks. The survey indicates a negative CPUE trend of relative abundance for shortfin mako shark. The CPUE trend for blue shark did not indicate a negative slope although that result was influenced by unusually large catches in 2000. The mean length of catch for shortfin mako and blue shark is apparently increasing. It is not know if this is because there are fewer young animals entering the local population or the proportion of larger animals has increased from offshore immigration of mature individuals. These trends do not necessarily indicate a decline in relative abundance; however, the data do indicate the need for continued monitoring.

Problems: None.

Key Contact: Dave Holts, (858) 546-7186.

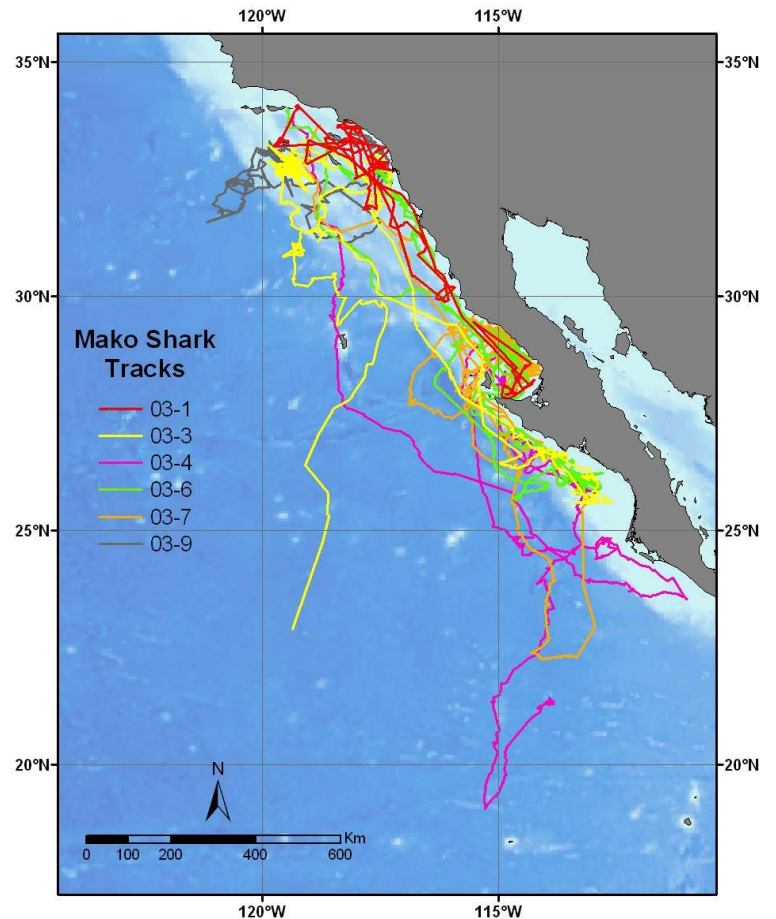


Figure 1. Six mako shark tracks as reported by the real-time satellite transmitting tags.

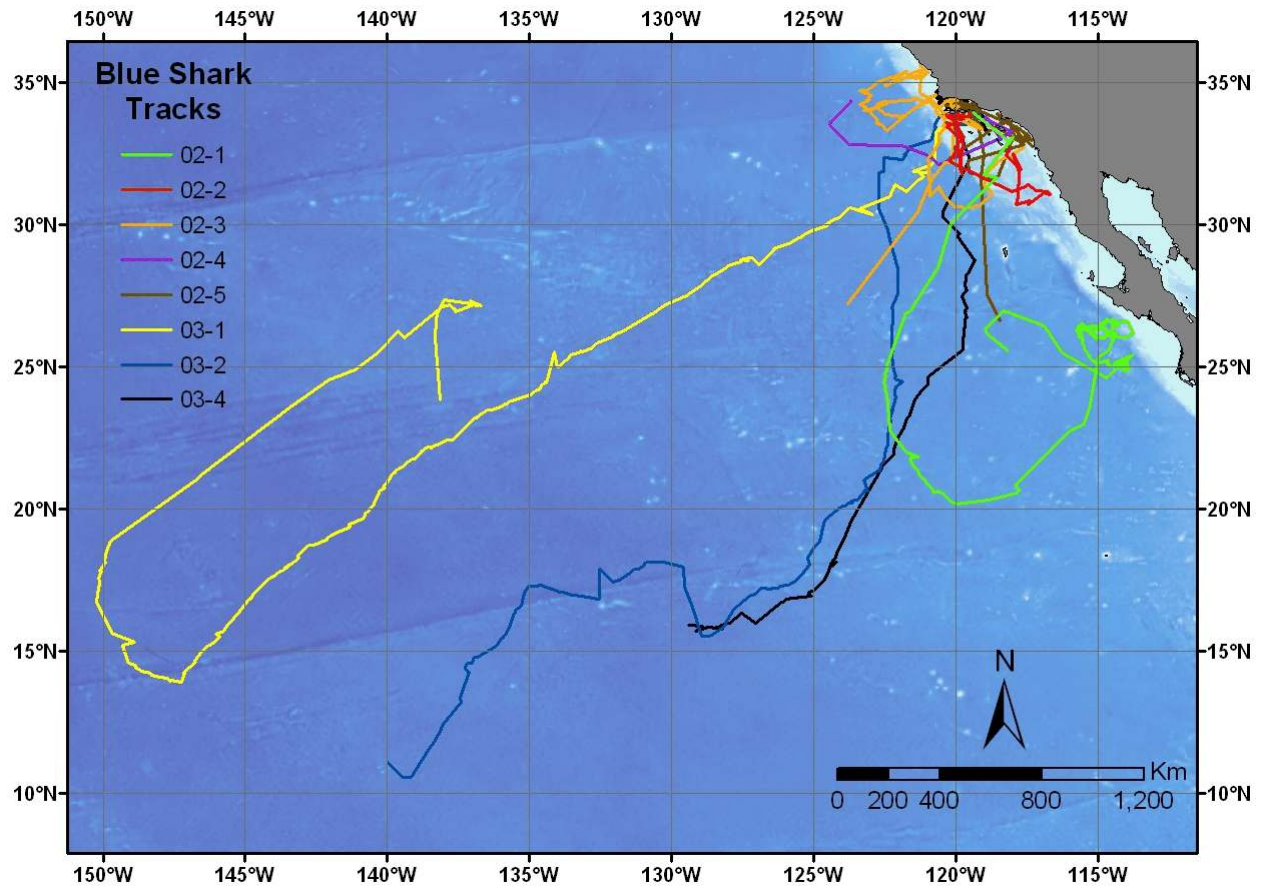


Figure 2. Eight blue shark tracks as reported by the real-time satellite transmitting tags.

Submitted by: Roger Hewitt, Director, Fisheries Resources Division.

Title of Accomplishment of Milestone: Survey of white abalone populations off San Clemente Island and Tanner Bank.

Current Status: Ongoing.

Background Information: The white abalone (*Haliotis sorenseni*) was listed as an endangered species in May 2001 based on a status review that indicated that less than 2,600 white abalone remained in the wild. Surveys have been conducted for the past three years to map abalone habitat and to determine population size. The first survey mapped critical habitat at San Clemente Island and estimated population size at this important locality. Historical landings indicated that 80% of all landings in the United States were from San Clemente Island. The second survey revisited Tanner Bank to monitor the status of white abalone at that location.

Purpose of Activity: To determine the abundance of white abalone in the U.S. Exclusive Economic Zone and to monitor populations for signs of recovery or continuing decline.

Description of Accomplishment and Significant Results: During the first cruise, 18 remotely operated vehicle dives were conducted for a total of 26 hours of survey time completed during seven working days of ship time (10 days total, Fig. 3). Two days were used to transit to San Clemente Island, and one day was lost due to naval activities in the survey area. Six white abalone were found (Fig. 4). The bathymetry of the entire southwestern side of San Clemente Island was mapped for future surveys. During the second cruise, 40 abalone sightings were made on 24 randomly selected transect lines. Data from this cruise are being analyzed to confirm species identification and calibrate the area searched during each transect before making density estimates. A previous survey of Tanner Bank in 2002 found 198 white abalone. Data will be further analyzed to determine whether this represents a decline or is within the confidence intervals of the survey.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): More than 4,000 hectares of habitat were mapped at San Clemente Island using multi-beam sonar. Further analysis is needed to define abalone habitat and population estimates.

Problems: On the first cruise, two days were used to transit to San Clemente Island and one day was lost due to naval activities in the survey area. On the second cruise, two days were used to transit to Tanner Bank and one day was lost due to weather.

Key Contact: John Butler, (858) 546-7149.

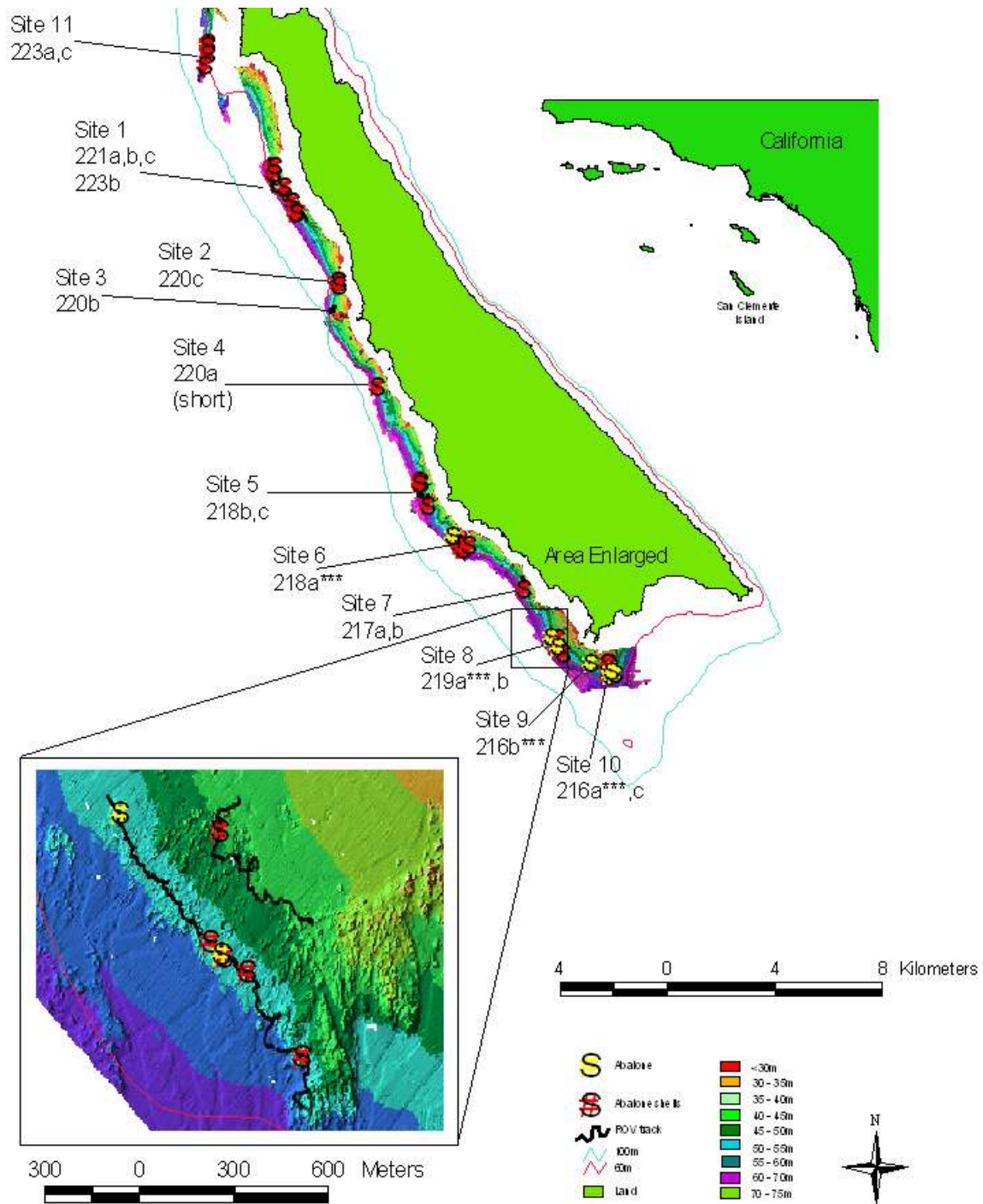


Figure 3. White abalone survey area off of San Clemente Island. The remotely operated vehicle tracks, abalone locations, and bathymetry are shown.

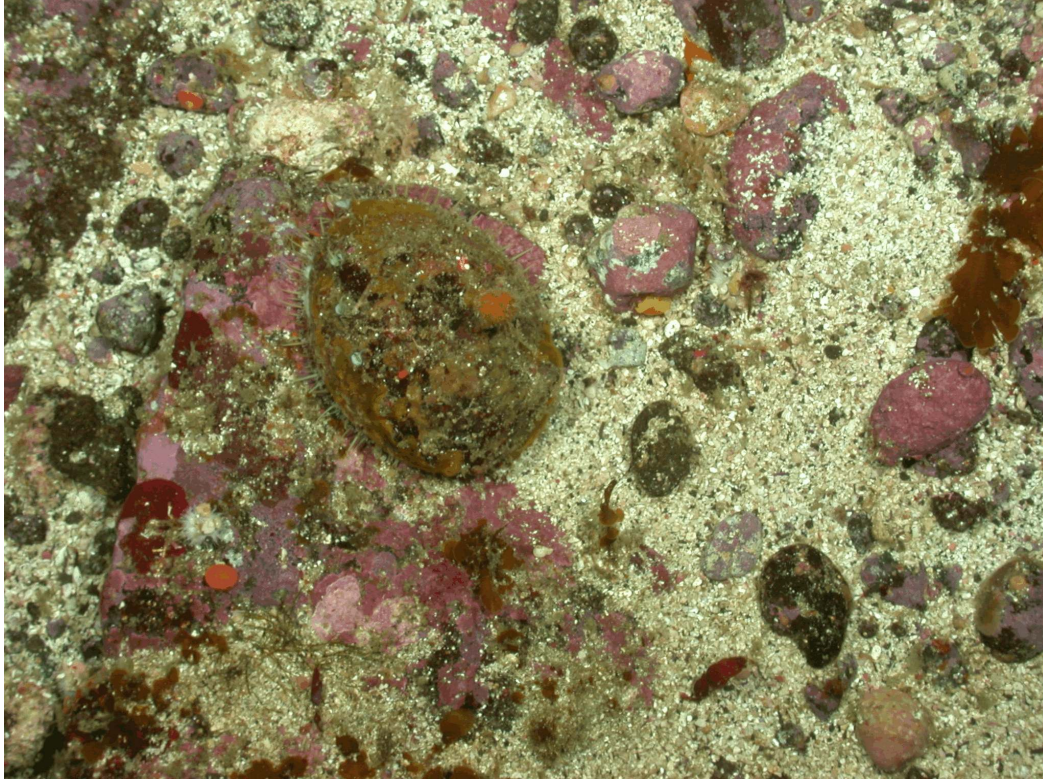


Figure 4. A white abalone found during the recent survey at San Clemente Island. Photo taken with a remotely operated vehicle.

Publications

Herrick, S. F., D. Squires, and C. A. Tisdell. 2004. Economic benefits of dolphins in the United States eastern tropical Pacific purse-seine tuna industry. *Environ. Resour. Econ.* 28(4):451-468.

Watson, W., and H. J. Walker Jr. 2004. The world's smallest vertebrate, *Schindleria brevipinguis*, a new pedomorphic species in the family Schindleriidae (Perciformes: Gobioidae). *Rec. Aust. Mus.* 56(2):139-142.

Watson, W., and L. L. Robertson. 2004. Development of kelp rockfish, *Sebastes atrovirens* (Jordan and Gilbert 1880) and brown rockfish, *S. auriculatus* (Girard 1854) from birth to pelagic juvenile stage, with notes on early larval development of black-and-yellow rockfish, *S. chrysomelas* (Jordan and Gilbert 1880) reared in the laboratory (Pisces: Sebastidae). NOAA Prof. Pap. NMFS 3, 30 p.

In Press

Hare, J. A., S. R. Thorrold, H. Walsh, C. S. Reiss, A. Valle-Levinson, and C. M. Jones. In press. Biophysical mechanisms of larval fish ingress into Chesapeake Bay. (submitted to Limnol. Oceanogr., accepted 2004).

Panteleev, G., B. deYoung, C. S. Reiss, and C. T. Taggart. In press. Passive tracer reconstruction as a least squares problem with a semi-lagrangian constraint: An application to fish eggs and larvae. J. Mar. Res. 62(6).

Piner, K. R., O. S. Hamel, J. L. Menkel, J. R. Wallace, and C. E. Hutchinson. In press. Age validation of canary rockfish (*Sebastes pinniger*) from off the Oregon coast (USA) using the bomb radiocarbon method. Can. J. Fish. Aquat. Sci.

Taylor, C. A., and W. Watson. In press. Utility of larval pigmentation to identify nearshore rockfishes (Sebastes) from southern California. Calif. Coop. Oceanic Fish. Invest. Rep. 45.

Taylor, C. A., W. Watson, T. Chereskin, J. Hyde, and R. Vetter. In press. Distributions of larval rockfishes, Sebastes, identified using molecular methods, suggest a pattern of retention near natal habitat in the Southern California Bight. Calif. Coop. Oceanic Fish. Invest. Rep. 45.

Wells, B. K., C. B. Grimes, J. C. Field, and C. S. Reiss. Covariation between the average lengths of mature coho (*Oncorhynchus kisutch*) and chinook salmon (*Oncorhynchus tshawytscha*) and the ocean environment (submitted to Fish. Oceanogr., May 2004)

LA JOLLA LABORATORY - SENIOR SCIENTIST FOR HIGHLY MIGRATORY SPECIES

Submitted by: Gary Sakagawa, Senior Scientist for Highly Migratory Species.

Title of Accomplishment or Milestone: Organize an intercessional meeting of the North Pacific Albacore Workshop (NPAW).

Current Status: Completed.

Background Information: The NPAW was established in 1974 in order to promote and accelerate joint research on north Pacific albacore among interested organizations, currently the Pacific Biological Station of Canada, Institute of Oceanography, National Taiwan University, National Research Institute of Far Seas Fisheries of Japan, and Southwest Fisheries Science Center. The NPAW has been following a multi-year work plan that concludes in December 2004 with a comprehensive assessment of the stock's status. As part of the work plan, an intercessional meeting was scheduled for July 2004.

Purpose of Activity: As a lead player in the NPAW, the SWFSC assisted in organizing the intercessional meeting. The meeting's primary objectives were to review data and data processing procedures used by Taiwan researchers for Taiwan longline data, deciding on corrective procedures as needed and to discuss procedures to be used for the stock assessment in December.

Description of Accomplishment and Significant Results: All of the objectives of the meeting were achieved. Led by SWFSC scientist Gary Sakagawa as chair of the meeting, participants were successful in identifying sources of errors in the data and data processing procedures. Corrective measures were developed and passed on to the researchers. Participants also agreed on methods and standard computer software to be used for the stock assessment.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): The meeting resolved long-standing issues with the longline data from the Taiwan fleet. Processing of the data can finally move forward and be available in time for stock assessment analyses in December.

Problems: None.

Contact: Gary Sakagawa, (858) 546-7177.

PACIFIC FISHERIES ENVIRONMENTAL LABORATORY

Submitted by: Frank Schwing, Supervisory Oceanographer.

Title of Accomplishment or Milestone: Improve understanding of variability in the California Current upper ocean structure.

Current Status: Completed.

Background Information: Dramatic declines in the biological production of the California Current ecosystem over the past several decades have been attributed to changes in the upper ocean structure. This lower productivity may be reflected in declining fishery populations. Despite this evidence, little effort has been placed on characterizing multi-decadal changes in upper ocean structure and thermal stratification in the California Current. Pacific Fisheries Environmental Laboratory research has built sequentially toward a better understanding of the mechanisms by which climate variability is exhibited in upper ocean conditions and ultimately marine populations.

Purpose of Activity: Develop and apply state-space models to detect and characterize changes in the long-term trends and seasonality of ocean temperature and thermal stratification in the upper 200 m of the California Current over the period 1950-1993.

Description of Accomplishment and Significant Results: Long-term increases in stratification and a deepening of the thermocline in the coastal California Current over the past 50 years imply that nutrient input to the photic layer and overall productivity has declined over time. The magnitude and timing of the seasonal cycle of thermocline strength and depth varies as well, potentially affecting the ambient conditions for seasonal upwelling and the timing of biological cycles in the California Current. Two recent peer-reviewed manuscripts describing these results have been published in the Journal of Geophysical Research: "Non-stationary seasonality of upper ocean temperature in the California Current" and "Long-term and seasonal trends in stratification in the California Current, 1950-1993."

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): This analysis has produced a set of leading environmental indicators for the FATE program. These are currently being used to force lower trophic models for the California Current and will be tested for their utility in explaining past variability in California Current fish populations. This continuing work will improve our understanding of how oceanographic changes in the California Current affect resource populations and ecosystem structure and production and will ultimately advance our ability to forecast future regime shift effects.

Problems: None.

Key Contact: Frank Schwing, (831) 648-9034; fschwing@pfeg.noaa.gov.

Submitted by: George Watters, Supervisory Research Fishery Biologist.

Title of Accomplishment or Milestone: Complete manuscript describing marine habitat use by chinook salmon off the coasts of California and Oregon during autumn.

Current Status: Manuscript was submitted to Marine Ecology Progress Series on January 16, 2004; initial revisions were completed and submitted May 10; final revisions were completed and submitted August 9; final version was accepted for publication August 12.

Background Information: Describing the ocean habitats used by chinook salmon (*Oncorhynchus tshawytscha*) is an important step toward understanding how environmental conditions influence their population dynamics. This manuscript is the first manuscript to be published from the data collected as part of the Pacific Fisheries Environmental Laboratory's ongoing habitat research.

Purpose of Activity: Identify and describe essential fish habitat for chinook salmon in the marine environment and develop an understanding of how these fish respond to changing ocean conditions at both individual and population scales.

Description of Accomplishment and Significant Results: The authors used data from archival tags that recorded time, temperature, and pressure (depth) to define the coastal habitats used by chinook salmon near Oregon and California during the autumns of 2000, 2002, and 2003. The authors used a clustering algorithm to summarize the data set from each year and identified four general habitats that described the set of ocean conditions used by chinook salmon. The four habitats, defined primarily by depth and the time of day that these depths were occupied, were characterized as 1) shallow day, 2) shallow night, 3) deep, and 4) deepest. The definitions and use of each habitat were similar across years and the thermal characteristics of all habitats included water temperatures between 9–12°C. This temperature range provided the best indicator of chinook habitat in the coastal ocean. Chinook salmon used 9–12°C water at least 52% of the time. Less than 10% of surface waters within the area where chinook were released and recovered provided these temperatures. Cross sections of subsurface temperatures suggest that between 25% and 37% of the coastal water column was available to chinook salmon and contained water in the 9–12°C range. These results support hypotheses that link salmon-population dynamics to ocean temperatures. Continued monitoring of surface and subsurface thermal habitats may be useful for assessing the extent and quality of conditions most likely to sustain chinook salmon populations.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): This manuscript identifies the conditions that chinook salmon actually experience while at sea off California and Oregon. Identifying these conditions will improve the ability of the NMFS to describe how changing ocean conditions may influence the production of these stocks.

Problems: None.

Key Contact: George Watters, (831) 648-0623.

Publications

Hinke, J. T., G. M. Watters, G. W. Boehlert, and P. Zedonis. In press. Ocean habitat use in autumn by chinook salmon in coastal waters of Oregon and California. Mar. Ecol. Progr. Ser.

SANTA CRUZ LABORATORY

Submitted by: Churchill Grimes, Director, Santa Cruz Laboratory; Peter Adams, Fisheries Branch Chief.

Title of Accomplishment or Milestone: Organization of joint California Water Environmental Modeling Forum/Central Valley Technical Recovery Team technical workshop "Using Models in Endangered Species Act Recovery Planning."

Current Status: Completed. The workshop was held September 7, 2004, in Sacramento. Notes from the workshop are being edited and will be posted on the California Water Environmental Modeling Forum Web site.

Background Information: Three salmon populations in California's Central Valley are listed under the Endangered Species Act (ESA): winter-run chinook salmon (endangered), spring-run chinook salmon (threatened), and steelhead (threatened). Recovery of these listed evolutionarily significant units is a multi-agency and multigroup collaborative effort. Many of these agencies and groups have a history of supporting salmonid population modeling for the purposes of assessment and recovery or are considering initiation of these types of modeling. The result is a large number of Central Valley modeling efforts some of which have not been particularly useful and sometimes duplicate each other.

Purpose of Activity: Identify the uses of and needs from salmonid population modeling for salmon recovery in the Central Valley. The workshop was intended to provide clear direction and purpose to Central Valley salmonid population modeling so that they can more fully contribute to salmon recovery.

Description of Accomplishment and Significant Results: The workshop brought together agency personnel, academics, and private consultants to survey how models can be used in Central Valley salmonid recovery and to identify important modeling objectives to improve their uses. The workshop reviewed the ESA recovery process and how models could contribute to that process, common problems when dealing with model complexity, and how models are used in ESA recovery in other areas. This was followed by individual presentations of modeling approaches currently in use, including integrated framework, individual-based models, and population viability analysis. Finally, a panel discussion focused on current models, their strengths and weaknesses, and whether current models are meeting recovery needs.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): The workshop resulted in strong recommendations for simple, single-issue models over large-scale comprehensive models. This is particularly true in the data-poor environment in the Central Valley where these comprehensive models can not be parameterized. These recommendations will bring improved direction and collaboration to modeling efforts in Central Valley ESA salmon recovery.

Problems: None.

Key Contacts: Peter Adams, (831) 420-3923; Steve Lindley, (831) 420-3921.

Submitted by: Churchill Grimes, Director, Santa Cruz Laboratory; Alec MacCall, Groundfish Analysis Team.

Title of Accomplishment or Milestone: Stock assessment of California sheephead.

Current Status: Completed and submitted.

Background Information: The Center for Stock Assessment Research (CSTAR) was created at the University of California Santa Cruz (UCSC) with NMFS funding for the purpose of training quantitative scientists to conduct stock assessments and related fishery analyses. The UCSC portion of CSTAR agreed to conduct a stock assessment of California sheephead (*Semicossyphus pulcher*) under a contract from the California Department of Fish and Game (CDFG) to UCSC/CSTAR.

Purpose of Activity: Determine the status of southern California's sheephead resource and provide CSTAR trainees with practical experience in conducting a stock assessment.

Description of Accomplishment and Significant Results: *Stock assessment.* The assessment utilized the stock synthesis maximum likelihood model for length-based assessment. Sheephead begin life as females and all become males after several years; sex change was explicitly included in the model. Sheephead abundance peaked in the 1980s, presumably due to favorable ocean conditions, but is now at the lowest abundance in several decades. After 40 years (1950-1990) of constant fishing mortality, fishing intensity tripled in the 1990s due to emergence of a lucrative live-fish fishery. Although female spawning biomass per recruit is near 50%, male spawning biomass per recruit is near 10%. The low abundance of males may contribute to reduced productivity.

Training: Alec MacCall (NMFS SWFSC) and Marc Mangel (UCSC) coached a team of two UCSC postgraduate researchers (Suzanne Alonzo and Teresa Ish) and a CDFG statistician (Meisha Key). Dr. Alonzo (now an assistant professor at Yale University) was senior author of the assessment. Members of the team received a thorough hands-on introduction to stock assessment, and all members would now be able to conduct such an assessment on their own.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): California sheephead is one of the most valuable fisheries in southern California and is managed by the state of California. The fish is not under Pacific Fishery Management Council authority, but fishing activities interact with species and fishing activities managed under the council's groundfish fishery management plan. The California Fish and Game Commission will consider sheephead management at its December 2004 meeting in Monterey, Calif. The assessment recommends a substantial reduction in fishing intensity, in keeping with the specifications of California's nearshore fishery management plan.

Problems: There were no significant problems.

Key Contact: Alec MacCall, (831) 420-3950; alec.maccall@noaa.gov.

Submitted by: Churchill Grimes, Director, Santa Cruz Laboratory.

Title of Accomplishment or Milestone: Conduct research cruise to intercalibrate direct observation and extractive survey methods off Central California.

Current Status: Completed.

Background Information: Scientists at the Santa Cruz Laboratory are using direct observation methods from an occupied submersible to survey fishes and habitats in 100 m water depth at the location of longline surveys conducted monthly in untrawlable rock habitats on the Central California shelf by the Groundfish Analysis Team and a commercial fisherman for the past three years.

Purpose of Activity: Compare survey results using direct observations along quantitative transects from an occupied submersible with those using extractive longlines for determining abundance, size and species composition, catchability coefficients and selectivity, and appropriate conversion factors for relative and absolute abundance of groundfish species at the locations of recent longline surveys as well as at varying distances away from the fished site. Secondary objectives were to use direct observations to ground truth habitat maps developed by U.S. Geological Survey (USGS) from remote acoustic surveys of our study site and to visually estimate fishing rates of active longline gear in complex habitats.

Description of Accomplishment and Significant Results: Underwater surveys of groundfishes and their habitats were conducted off Central California using non-extractive video-transect methodologies and direct observations from an occupied research submersible. During this 12-day study, researchers made 46 submersible dives (about 70 hrs underwater), at depths from 63 to 120 m (but largely between 90 to 100 m). The researchers conducted 19 dives on 22 sites previously surveyed using commercial longline fishing gear and 10 dives on similar sites at varying distances north and south of the fished site. During four dives the scientists surveyed newly set and actively fishing longline gear; they also surveyed these same sites before and after the gear was deployed. Two dives were made by a geologist (USGS) who is assisting with ground truthing digital, geo-referenced habitat maps of the seafloor, and one dive was made by a commercial longline fisherman who has been participating in this project for three years. These surveys were conducted August 23 to September 6, 2004, and all videotapes and navigational data are being processed and analyzed. Data on fish species composition, size, habitat, and abundance are being entered into an ACCESS database for further analyses.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): Results of our direct observation surveys can improve and enhance stock assessments by forming the basis for monitoring trends in the groundfish assemblage (as opposed to single species) in untrawlable shelf habitats and by estimating catchability characteristics of extractive methods. We will improve our understanding of fish assemblages, associated habitats, and functioning ecosystems, and assist in our interpretation of results from extractive surveys.

Problems: None.

Key Contact: Mary Yoklavich, (831) 420-3940; mary.yoklavich@noaa.gov.

Submitted by: Churchill Grimes, Director, Santa Cruz Laboratory.

Title of Accomplishment or Milestone: Marine migration and estuary use of green sturgeon.

Current Status: Ongoing.

Background Information: Green sturgeon is a candidate for listing under the Endangered Species Act (ESA). There are significant concerns about the status of green sturgeon due to its life history characteristics (long lived, late maturing), habitat degradation, and incidental harvest in salmon gillnet and coastal trawl fisheries. A recent status review was unable to come to a firm conclusion about the status of green sturgeon due to a lack of information on stock structure, current abundance, or trends in abundance.

Purpose of Activity: Tag green sturgeon to document their movements among the ocean, coastal bays, estuaries and rivers. This coast-wide acoustic tagging program was initiated in FY03 in collaboration with the NMFS Northwest Fisheries Science Center, Yurok Tribal Fisheries, Wildlife Conservation Society, U.S. Geological Survey, U. S. Fish and Wildlife Service, University of California Davis, and Oregon State University. The resulting information on movement will be used to estimate population abundance (in conjunction with future in-river censuses) and identify the sources of fish in mixed stocks subject to incidental take.

Description of Accomplishment and Significant Results: To date, approximately 180 green sturgeon have been tagged in the Rogue, Klamath and Columbia rivers and Willapa and San Pablo bays, and acoustic receivers have been deployed in these areas as well as the Umpqua, Coos and Sacramento rivers. We have documented movement of individuals among most of these locations and have shown that aggregations in Willapa Bay are a complex mixture of fish from all known spawning areas. Forty-one individual green sturgeon have been detected off Vancouver Island by the Pacific Ocean Salmon Tracking project. Some green sturgeon appear to reside in marine waters off Vancouver Island, while others tagged at the same time and place reside in coastal bays and the Columbia River.

Significance of Accomplishment (e.g., to the Center, to Management, and to NMFS Strategic Plan Goals): We have shown that acoustic tagging combined with automated hydrophones can provide critical data useful for the management and conservation of green sturgeon in a timely and cost-effective manner. Before this study, the distribution of green sturgeon was known only from incidental captures in fisheries, and the source of these fish was unknown. With a modest expansion of the study, or future independent work, we will be able to estimate the size of spawning populations of green sturgeon, which will provide a baseline for future status assessments.

Problems: The funding for this project, supplied by the NMFS Office of Protected Resources' Candidate Species Program, was cut in FY04.

Key Contact: Steve Lindley, (831) 420-3921 .

Publications

Dalton, M. G., and S. Ralston. 2004. The California rockfish conservation area and groundfish trawlers at Moss Landing harbor. *Mar. Resour. Econ.* 19(1):67-83.

Garza, J. C., L. Gilbert-Horvath, J. Anderson, T. Williams, B. Spence, and H. Fish. 2004. Population structure and history of steelhead trout in California. *In* J. Irvine et al. (eds.), *Workshop on Application*

of Stock Identification in Defining Marine Distribution and Migration of Salmon (Honolulu, Hawaii, USA, November 1-2, 2003). North Pac. Anadromous Fish Comm. Tech. Rep. 5:129-131.

Klamath River Technical Advisory Team. 2004. Klamath River fall chinook age-specific escapement, 2003 run. Klamath Fishery Management Council, Yreka, California. 16 p.

Klamath River Technical Advisory Team. 2004. Ocean abundance projections and prospective harvest levels for Klamath River fall chinook, 2004 season. Klamath Fishery Management Council, Yreka, California. 30 p.

Laidig, T. E., K. M. Sakuma, and J. A. Stannard. 2004. Description and growth of larval and pelagic juvenile pygmy rockfish (*Sebastes wilsoni*) (family Sebastidae). Fish. Bull. 102(3):452-463.

Salmon Technical Team. 2004. Preseason report I: stock abundance analysis for 2004 ocean salmon fisheries. Pacific Fishery Management Council, Portland, Oregon. 90 p.

Salmon Technical Team. 2004. Preseason report II: analysis of proposed regulatory options for 2004 ocean salmon fisheries. Pacific Fishery Management Council, Portland, Oregon. 39 p.

Salmon Technical Team. 2004. Review of 2003 ocean salmon fisheries. Pacific Fishery Management Council, Portland, Oregon. 306 p.

Salmon Technical Team and Council Staff. 2004. Preseason report III: Analysis of council adopted management measures for 2004 ocean salmon fisheries. Pacific Fishery Management Council, Portland, Oregon. 30 p.

Schick, R. S., A. L. Edsall, and S. T. Lindley. 2004. Historical and current distribution of Pacific salmonids in the Central Valley, California. SWFSC Admin. Rep., Santa Cruz, SC-2004-01.

In press

Hayes, S. A., M. H. Bond, C. V. Hanson, and R. B. MacFarlane. In press. Interactions between endangered wild and hatchery salmonids: can the pitfalls of artificial propagation be avoided in small coastal streams? Journal of Fish Biology.

MacCall, A. D., H. Batchelder, J. King, D. Mackas, N. Mantua, G. A. McFarlane, I. Perry, J. F. Schweigert, and F. Schwing. In press. Recent ecosystem changes in the California Current system. In Report of the PICES Study Group on Fisheries and Ecosystem Responses to Recent Regime Shifts. North Pacific Marine Science Organization.

Current manuscripts

Amend, M., M. Yoklavich, Y. Rhzanov, C. Grimes, and W. Wakefield. In prep. Mosaics of benthic habitats using laser line scan technology: It's in the details.

Anderson, E. C., and K. K. Dunham. In prep. SPIP 1.0: program for simulating pedigrees and genetic data in age-structured populations.

Barnett-Johnson, R. C., F. C. Ramos, C. B. Grimes, and R. B. MacFarlane. In prep. Identifying the natal origin and migration history of adult salmon using Sr isotopes obtained by laser ablation MC-ICPMS.

Black, B. A., G. W. Boehlert, and M. M. Yoklavich. In review. Using tree-ring crossdating techniques to validate age in longlived fishes.

Field, J. C., and S. Ralston. In prep. Spatial variability in California Current rockfish recruitment events.

Kahn, R. G., D. E. Pearson, and E. J. Dick. Submitted. Comparison of standard length, fork length, and total length for measuring fish.

Newman, K. B., and S. T. Lindley. In prep. Modeling the population dynamics of winter-run chinook salmon.

Pipal, K. A., and S. T. Lindley. In prep. Summary of monitoring activities for ESA-listed salmonids in California's Central Valley.

Sakuma, K. M., C. A. Taylor, and W. Watson. In review. Pigment variability in larval shortbelly rockfish, *Sebastes jordani*, off central California.

Tissot, B. N., M. M. Yoklavich, M. S. Love, K. York, and M. Amend. In prep. Structure-forming invertebrates as components of benthic habitat on deep banks off southern California.

Tomberlin, D., and V. Bosetti. In prep. Solving real options models of fisheries investment when salvage value is difficult to estimate.

Wells, B. K., C. Grimes, J. C. Field, and C. S. Reiss. In review. Covariation between the average lengths of mature coho and chinook salmon and the ocean environment.